

Running Head: The Effect of Distraction

The Effect of Distraction During Exercise on Feeling States

Emily N. Dill

and Dr. Gerene Bauldoff

The Ohio State University

College of Nursing

Abstract

PURPOSE: To evaluate the effect of distraction (auditory or visual) versus no distraction during exercise on feeling states in healthy adult aerobic exercisers. Hypotheses: 1) Healthy adults who aerobically exercise using distraction (auditory or visual) will report improvement in their post-exercise feeling states as compared to their pre-exercise feeling states during the single aerobic exercise session, 2) Auditory distraction will impact feeling states more positively as compared to visual distraction or no distraction when used during aerobic exercise; and 3) Exercise self-efficacy has a moderating influence on feeling states during aerobic exercise. Feeling states were measured by the Exercise-Induced Feelings Inventory (EFI) comprised of four subscales (revitalization, positive engagement, physical exhaustion, and tranquility). Exercise self-efficacy was measured using the Exercise Self-Efficacy Scale (ESE).

METHODS: A quasi-experimental three-group pretest-posttest design with convenience sampling was used. The subjects self-selected to one of three groups (auditory distraction, visual distraction, or control) according to their planned use of distraction during the single aerobic exercise session, with a total of 30 subjects (ten per group). Each subject completed EFI, ESE, and demographic questionnaires prior to exercise, and EFI post-exercise. The data was analyzed using a 3x2 Analysis of Covariance (ANCOVA), comparing the mean EFI subscores (pre- and post-exercise) across the three groups, using the ESE score as a covariate to control for self-efficacy. The alpha level was set at 0.05.

FINDINGS: Significant differences were noted between groups for exercise self-efficacy score [ESE] ($F=3.549$, $df\ 2$, $p=0.043$), with the control group found to have significantly lower ESE scores than either the music distraction or visual distraction groups. Significant change for the EFI revitalization subscore ($p=0.037$) was noted when both distraction groups were combined for t-test analysis. No significant differences were seen across groups for the other three subscales. Using the ESE score as covariate (ANCOVA), no significant differences were noted

for any of the EFI subscores between groups. However, significant improvements were noted across all groups from pre- to post-test for EFI positive engagement ($p = 0.001$) and EFI revitalization ($p = 0.000$). A strong positive correlation is noted between the EFI Positive Engagement and EFI Revitalization subcores ($r = 0.809$, $p = 0.00$). However, little correlation is noted between ESE and EFI Positive Engagement ($r = 0.006$, $p=0.975$), ESE and EFI Revitalization ($r = 0.072$, $p=0.711$), ESE and EFI Physical Exhaustion ($r = 0.199$, $p=0.301$) or ESE and EFI Tranquility ($r = 0.141$, $p=0.466$).

CONCLUSION: Distraction as a combined group showed a significant change in revitalization compared to the control group. Significant improvement in two EFI subscales for all three groups adds further support to the evidence for the positive emotional effects of aerobic exercise. However, the moderating influence of exercise self-efficacy on feeling states is not supported in this study. Results showed no support for the greater effectiveness of one type of distraction over the other. This study suggests that exercise distraction may be useful for improving certain aspects of feeling states.

Chapter I.

A. Introduction

With exercise as a major factor in individual health maintenance, finding ways to effectively promote exercise has become increasingly important in health care. Considerable research has been done on the use of distraction in exercise to determine whether it is associated with decreased perception of physical exertion, greater adherence to an exercise regimen, and increased exercise performance as measured by distance, length of exercise time, or maximum workload. A summary of relevant research supports the effectiveness of music distraction, but there is little support for visual distraction. The discussion is limited on why this is so, and a particular gap in the available literature is the relationship of feeling states with these two forms of distraction and whether changes in feeling states are associated with effectiveness of distraction. Determining whether such an association exists would add to the advanced knowledge base of the behavioral and emotional aspects of exercise. With health promotion as a significant element of nursing, this research is relevant to practice in that it would enhance understanding of what helps patients to exercise better, thus allowing nurses to make helpful recommendations based on what has been shown to be effective.

B. Purpose of the Study

The purpose of this pilot study is to evaluate the effect of distraction (auditory or visual) versus no distraction during exercise in healthy adult aerobic exercisers on feeling states as measured by the Exercise-Induced Feelings Inventory (EFI). In addition, the relationship between exercise self-efficacy and feeling states will be evaluated using the Exercise Self-Efficacy Scale (ESE).

1. Research Questions and Hypotheses

Q1: Do healthy adults who aerobically exercise using distraction (auditory or visual) or no stimuli (control) differ in their feeling states?

H.1.1: Healthy adults who aerobically exercise using distraction (auditory or visual) will report improvement in their post-exercise feeling states as compared to their pre-exercise feeling states during the single aerobic exercise session.

Q2: Does the type of distraction (auditory versus visual) as compared to no distraction have differential effects on feeling states during aerobic exercise?

H.2.1 Auditory distraction will impact feeling states more positively as compared to visual distraction or no distraction when used during aerobic exercise.

Q3: Is exercise self-efficacy a significant variable in determining feeling states during aerobic exercise?

H.3.1 Exercise self-efficacy has a moderating influence on feeling states during aerobic exercise.

C. Definition of Terms

The conceptual definitions for this study include the following:

- Distraction – use of media to entertain or occupy the mind
- Exercise self-efficacy - one's belief that he or she can successfully perform a desired behavior over a specific period of time
- Feeling states– emotional states determined by internal and external factors and experienced subjectively by the individual

The operational definitions of variables for this study include the following:

- Auditory distraction – the voluntary use of a personal CD or MP3 player with headphones to listen to music while performing aerobic exercise
- Visual distraction – the voluntary use of any written material (textbook, magazine, newspaper, etc.) to read while performing aerobic exercise

- Aerobic exercise – use of treadmill, stationary bike, or elliptical fitness crosstrainer (EFX) with the purpose of sustained activity to generate aerobic conditioning
- Feeling states – emotional states including revitalization, tranquility, positive engagement and physical exhaustion as measured by the EFI
- Exercise self-efficacy – self-confidence to participate in exercise behaviors as measured by the ESE

Chapter II.

Review Of Literature

A. Conceptual Framework

Distraction is the use of auditory or visual stimuli to occupy the sentient thought process. According to Berger and Motl (2000), distraction is postulated to increase activity enjoyment when used during exercise. The underlying concept is the distraction of the exerciser from the potentially negative sensations of effortful exercise (Berger & Motl, 2000).

B. Review of Related Literature

1. Exercise

Physical activity and fitness are identified as focal areas for Healthy People 2010 (U.S. Department of Health and Human Services [USDHHS], 2000) and Healthy Campus 2010 (American College Health Association, 2003). This study aligns with both priorities, evaluating a simple intervention (distraction) to determine its impact on feeling states during exercise.

2. Exercise and Feeling States

The data on a relationship between exercise and feeling states are inconclusive. In one study, mood and exercise have been shown to be correlational but not necessarily directional, with a lack of evidence indicating that regular exercise causes improved mood (Sexton et al., 2001). Another study showed improved post-exercise mood for all subjects, suggesting that exercise influences change in feeling states (Russell, Pritschet, Frost, Emmett, Pelley, Black, and Owen, 2003). While recognizing exercise itself as a possible factor in determining feeling states, this study will not attempt to control for this as a variable.

3. Exercise Self-Efficacy

Bandura's Social Cognitive Theory suggests that through cognition, future consequence can serve as a motivator (Bandura, 1986). Self-efficacy, defined as one's belief that he can successfully perform a desired behavior, is an important construct in behavior motivation

(Bandura, 1997). Self-efficacy determines one's willingness to attempt a given behavior, persistence when faced with difficulty and ultimately, success or failure (Bandura, 1997). While the Social Cognitive Theory contains other important components, self-efficacy is the construct of interest in this proposal. Exercise self-efficacy has been reported to explain a significant proportion of the variance in exercise adherence in adults, indicating its importance in maintaining exercise behaviors (McAuley, 1993).

4. Exercise Self-Efficacy and Feeling States

Research has also examined the relationship between exercise self-efficacy and feeling states in the adolescent population (Robbins, Pis, Pender, and Kazanis, 2004). A total of 168 adolescents were categorized by race, gender, and developmental stage and rated the following: pre- and post-exercise self-efficacy for physical activity, feeling states at intervals throughout the exercise session, and enjoyment of the exercise session. Significant findings included positive correlations between both pre- and post-exercise exercise self-efficacy scores and feeling states (2004). This suggests that self-efficacy is an influential variable not only in exercise performance and adherence but also in the subjective experience of activity as measured by feeling states.

5. Distraction

A variety of studies have been done to examine the effects of distraction on exercise. Distraction conditions can be divided into two categories: music and visual, the latter of which includes television, reading, and (in one study) mental tasks presented on slides. The effects under investigation in these studies included subjective experience of exercise and objective exercise performance. Subjective experience was evaluated by perceived exertion and symptoms as rated by participants, while objective performance was measured by biophysiological variables such as heart rate, workload, length of time per exercise session, and distance (Annesi, 2001; Bauldoff, Hoffman, Zullo, and Sciurba, 2002; De Bourdeaudhuij,

Crombez, Deforche, Vinaimont, Debode, and Bouckaert, 2002; Emery, Hsiao, Hill, and Frid, 2003; Fillingim, Roth, and Haley, 1989; Hull and Potteiger, 1999; Potteiger, Schroeder, and Goff, 2000; Szabo, Small, and Leigh, 1999;).

a. Music as Auditory Distraction

Music can be effective as distractive stimuli when used with exercise, leading to better tolerance of increased levels of training and a reduced perception of dyspnea on exertion (Pennebaker & Lightner, 1980). Boutcher and Trenske reported that perceived exertion was reduced during exercise when music was introduced in contrast to an increased perception of exertion with sensory deprivation (Boutcher & Trenske, 1990). Altshuler theorized that music alters mood unconsciously through the stimulation of an autonomic response at the thalamic level (Altshuler, 1948). Auditory nerve impulses trigger a thalamic response that influences the limbic system. The response can be either sympathetic or parasympathetic and can have an effect on the sleep-wakefulness cycles, hormone release, heart rate, blood pressure, and other physiologic parameters (Jerman & Haggarty, 1993). Nevertheless, as noted by McClelland, there is no well-defined scientific explanation for why we respond to music, nor evidence of whether all people respond positively to music (McClelland, 1988).

Studies using music distraction during exercise as an independent variable have produced mixed results, with the weight of evidence supporting the theory that music is effective as a distractor. One study of the effect of music on perceived exertion used twenty-seven subjects who were assigned to ride a cycle ergometer for four twenty-minute sessions on different days. During each session, the subjects either listened to one of three types of music (fast, classical, or self-selected) or exercised without music, and rated their peripheral, central and overall physical exertion on Borg's scale every five minutes throughout the cycle ride. They were also monitored for heart rate throughout each session. While there was no significant effect of music distraction on heart rate, ratings of perceived exertion were significantly lower for sessions with music than those without (Potteiger, Schroeder, and Goff, 2000).

Because tempo (the rate of the beat) is an integral element in music, researchers in another study looked at the effect of music in exercise with conditions determined by tempo. Twenty-four subjects participated in five sessions riding a stationary cycle and listened to either slow, fast, slow-to-fast, fast-to-slow, or no music while exercising. Subjects' heart rates were monitored and their exercise workload (measured in watts) was systematically increased throughout each session to the point of quitting due to exhaustion. Again, no significant effect was found for tempo condition on heart rate, but a significantly higher workload was achieved for the slow-to-fast music tempo. These findings suggest that tempo plays a part in the effectiveness of music as distraction (Szabo, Small, and Leigh, 1999).

While most studies have been done with adults, and more specifically college students, a study performed with thirty obese children and adolescents used music distraction during treadmill running sessions. The subjects did two sessions, one with music and one without, both before and eight months into a weight loss program. The variables of concern were running time, bodily sensations rated on a questionnaire, and physiological measures of heart rate and respiratory performance. Significant results were that running time was longer for sessions with music, and physiological values were lower without music (De Bourdeaudhuij, Crombez, Deforche, Vinaimont, Debode, and Bouckaert, 2002).

Another study used music as distraction in a specific population – individuals diagnosed with chronic obstructive pulmonary disease. The sample comprised 24 individuals aged 68.1 ± 8 years. The study design consisted of a walking exercise routine that extended over eight weeks during which half of the sample was required to listen to music as they walked and the other half used no music distraction. A main variable was distance walked in six minutes, measured for two walks each at the beginning of the study and after both four and eight weeks of the exercise regimen. Breathlessness and fatigue were also evaluated on a zero to 10 scale following each six-minute walk. At the end of the study, the music group had a significantly higher six-minute

walk distance compared to the control group by an average of 445.4 feet, with no significant difference in breathlessness and fatigue (Bauldoff, Hoffman, Zullo, and Scieurba, 2002).

A study by Annesi randomized 56 adults between ages 22 and 56 among three distraction conditions – music, television, and combined entertainment (either music or television per subject's choice, but subjects overwhelmingly chose television) – and a no-distraction control group to compare exercise session duration and maximum oxygen uptake volume. A variety of cardiovascular machines were available for the subjects' choice for voluntary exercise sessions throughout the 14 weeks of the study, such as stationary bicycles, stair stepping machines, treadmills, and elliptical machines. Significant differences in session duration and maximum oxygen uptake volume were found for the combined entertainment group only; because there were essentially two television groups with differing results, there is no real support for the greater effectiveness of either form of distraction over the other (Annesi, 2001).

b. Visual Distraction

Research on visual distraction during exercise has provided little evidence of its effectiveness. A study that compared exercise intensity in treadmill running had 10 subjects complete two sessions using videos as distraction, with one high-action video content condition and one low-action content condition, as well as a distraction-free control session. The runs were 30 minutes in duration and subjects were instructed to maintain a rating of perceived exertion predetermined by a graded exercise test. Results for heart rate, oxygen consumption, and running velocity showed no significant differences among the conditions, showing no apparent effect of visual distraction on exercise performance (Hull and Potteiger, 1999). Another study compared RPE and stationary bike riding time for 60 subjects randomized among three groups – high-demand distraction, low-demand distraction, and no distraction control. The distraction was alphabetical tasks involving letters and words presented on slides during exercise, with the level of difficulty varying between the high- and low-demand groups. The

data showed no significant differences in RPE or riding time (Fillingim, Roth, and Haley, 1989).

6. Music and Mood

It is clear that music affects mood, with the extent and direction of change related to music type. Smith and Noon chose six types of music – described as vigorous, fatigued, angry, depressed, tense, and all moods -- to correlate to the six mood subscales on the Profile of Mood States (POMS), and tested change in mood state after listening to each type. A convenience sample of 12 subjects completed a POMS prior to each music session, listened to one of the types of music, and then completed a second POMS. Each subject listened to each of the six types of music, with one session per week in random order. The music types associated with significant change in mood were angry, depressed, tense, and all moods; the vigorous selection had the greatest mean positive change, although it was not statistically significant (the small sample size should be kept in mind when evaluating the results) (Smith and Noon, 1998).

A larger study with 144 subjects used music types identified as grunge rock, New Age, classical, and designer (“created with the goal of producing a positive effect on mood, tension, and mental clarity”), (McCraty, Barrios-Choplin, Atkinson, and Tomasino, 1998). The Personal Feelings Survey, which measures mood state based on a positive (vigorous-fatigued) and negative (hostile-relaxed) affect theory was used to assess subjects’ mood state before and right after listening to each type of music selection. Significant changes on at least one POMS subscale were found for each type, with grunge music associated with more negative feelings (e.g., sadness) and designer music associated with more positive feelings (e.g., relaxation) (McCraty et al., 1998).

7. Exercise Distraction and Mood

Both music and visual distraction have been examined during exercise for association with mood change. The results for the use of music distraction are varied. A unique study

conducted in Japan recruited 16 middle-aged females to participate in three bench-stepping exercise sessions, with two music conditions – aerobic dance and traditional Japanese folk music – as well as a metronome-only control condition. Each session was a total of one hour in length, including warm-up and cool-down periods. This study utilized a pre- and post-exercise Profile of Mood States-Short Form to measure mood. An increase in vigor for the aerobic dance music condition and an increase in fatigue for the control condition were significant results (Hayakawa, Takada, Miki, and Tanaka, 2000).

There is also data that does not support the effect of music distraction on mood. A study focusing on the effect of music distraction during exercise on cognitive performance also measured mood changes. The study included 33 adults diagnosed with coronary artery disease who served as their own control group by performing two sessions of self-determined length on a treadmill, one with music and one without. A portion of the Profile of Mood States-Short Form (POMS-SF) – only the depression-dejection and tension-anxiety factors – was given both before and after each treadmill session. Results showed no significant effects of music distraction on mood change, although mood improved overall from pre- to post-exercise for both conditions, pointing to the effect on mood of exercise itself (Emery, Hsiao, Hill, and Frid, 2003).

The effect of visual distraction on mood during exercise was researched in a similar pre- and post-exercise POMS design. The distraction conditions consisted of video and reading, and the 53 subjects were randomized among the two as well as a control condition with no distraction. While there were significant mood changes associated with the entire group of subjects as a whole, suggesting that exercise itself is directly related to mood change, there were no significant differences among the three conditions (Russell, Pritschet, Frost, Emmett, Pelley, Black, and Owen, 2003).

C. Summary

A review of the relevant literature suggests that auditory distraction during exercise appears to have a significant effect on both objective exercise performance and the subjective exercise experience. The literature on visual distraction does not indicate that it has a similar effect. Music has been shown to have a correlation with feeling states which may carry over into use during exercise, while visual distraction has no apparent influence on mood during exercise. There is a current lack of literature on the relationship between feeling states and auditory and visual exercise distraction, as moderated by exercise self-efficacy, which is the purpose of this study.

Chapter III.

Methods

A. Design

This study used a three-group quasi-experimental pretest-posttest design with convenience sampling. The subjects self-selected to one of three groups according to their planned use of distraction during the single exercise session. The groups included auditory distraction, visual distraction and attention control (no distractive activities). No randomization to group was attempted within this study.

B. Sample and Setting

1. Sample

The sample consisted of Ohio State University students, faculty, and staff who have free access to the facility with their university identification card.

a. Inclusion Criteria

Each subject enrolled in the study was required to be:

- i. A student, faculty member, or employee of The Ohio State University
- ii. Eighteen years or older
- iii. Able to speak and read English
- iv. Able to participate in aerobic exercise without undue risk due to pre-existing disease, injury, or other condition
- v. Planning to use aerobic exercise machines (specified as the treadmill, stationery bicycle, or EFX)

b. Exclusion Criteria

Subjects were excluded from this study if they were:

- i. Not a student, faculty member, or employee of the Ohio State University
- ii. Under eighteen years old

- iii. Unable to speak and read English
- iv. Suffering from a pre-existing disease, injury, or other condition that poses a risk during exercise
- v. Not planning to use the specified aerobic exercise machines.

2. Setting

The study was conducted at the Jesse Owens South athletic facility on The Ohio State University main campus in Columbus, Ohio, with permission from the facility director. The times for data collection were determined by the researcher to accommodate both the facility's hours of operation and researcher availability.

Feeling states were measured using the Exercise-Induced Feelings Inventory (EFI), developed by Gauvin and Rejeski (1993). The EFI provides the momentary experience of feeling states, or mood. The EFI is a 12-item scale that requires participants to indicate, on a 5-point Likert-type scale ranging from do not feel (0) to feel very strongly (4). Four distinct feeling states (subscales) that the EFI measures include positive engagement, revitalization, physical exhaustion, and tranquility. The multidimensional structure of the EFI is supported by confirmatory analysis with an eigenvalue of > 1.0 . The total variance explained by the 12 items of the instrument is 79.71%. Internal consistency for the subscales when collected pre-exercise include revitalization (Cronbach's $\alpha = 0.87$), physical exhaustion (Cronbach's $\alpha = 0.91$), tranquility (Cronbach's $\alpha = 0.82$) and positive engagement (Cronbach's $\alpha = 0.82$). When evaluated for construct validity, the EFI was found to be very sensitive to changes in feeling states that occur with exercise (Gauvin & Rejeski, 1993).

Self-efficacy related to exercise behavior was measured using the Exercise Self-Efficacy Scale (ESE) by McAuley (1993). The ESE is composed of eight items. Participants were instructed to indicate their degree of confidence for each item on a 11-point (0% = no confidence at all) to 100% = complete confidence) scale. The confidence scores were summed and divided by the total number of items giving a possible range of 0-100%. The ESE is

reported to have internal consistency reliability (Cronbach's $\alpha = 0.95$). This instrument has been shown to be predictive of exercise behavior, supporting the reliability and validity of this instrument (McAuley, Jerome, Marquz, Elavsky & Blissmer, 2003).

C. Demographic Data

A demographic questionnaire was used to obtain the following information: age, gender, education level, type of exercise performed, and self-selected distractive stimuli, if applicable. This information was collected to provide important information related to the sample characteristics in relation to external validity and generalizability.

D. Procedure for Data Collection

The researcher (Emily Dill, undergraduate nursing student at The Ohio State University) was stationed at the front table where each person who enters the facility is required to have his university identification card scanned, allowing the researcher to ask each one if he would like to participate in undergraduate research. Those who responded with interest were given a brief oral explanation of the study with identification of the two distraction groups and the control group. If the potential subject expressed interest in participation, a copy of the informed consent with a written explanation of the study was presented. Once the informed consent was signed and the subject had self-selected to a group, the subject received a blank envelope containing a demographic questionnaire, an Exercise Self-Efficacy (ESE) questionnaire and two Exercise-Induced Feeling Inventory (EFI) questionnaires. The researcher provided verbal directions to fill out the ESE and the pre-exercise EFI before exercising, with instructions to respond to the EFI "based on how you feel at this moment." This provided a baseline against which to evaluate post-exercise mood changes. The subject then proceeded with the exercise routine of choice. The study was intended to have no effect on the manner or duration of subject's personal regimen. Upon completion of exercise, the subject filled out the post-exercise EFI with

instructions to respond “based on how you feel at this moment ” The subject then returned the envelope and its contents to the researcher before leaving the facility. A small incentive (water bottle) was available to all participants who completed the study, to be awarded upon return of the envelope and questionnaires. An equal number of envelopes were prepared for each of the three groups and the study continued until all groups were filled, regardless of which group reached its quota first. Only the investigator and advisor had access to patient identity and data.

E. Protection of Human Subjects

The human rights of all subjects were regarded with the respect required by nursing research. Approval for this study was sought from the Ohio State University Psychosocial Institutional Review Board. Because the intervention was self-selected by the subjects and posed no threat to physical or emotional well-being, there was no risk of harm to any participants. Self-determination was assured in that all potential subjects were approached without any element of coercion and had complete freedom to refuse without negative consequences. The individual who responded with interest was given a brief oral explanation of the purpose and method of the study, and was required to sign the informed consent prior to participation.

Confidentiality will continue to be upheld by the storage of all collected information in the office of Dr. Gerene Bauldoff at the Ohio State University College of Nursing, with access permitted only to the researchers and advisors. Subjects were not required at any time to use names on any questionnaire, and informed consent will be kept separately from data.

F. Power Analysis

A power analysis was completed to determine appropriate sample size for this study. With the alpha set at 0.05, power set at 0.80 and a medium effect size, a minimum of nine

subjects is needed for each group. Recruitment is planned for 10 subjects per group (total n = 30) to allow for any unforeseen variation within the groups due to the small sample size.

Chapter IV.

Results

A. Recruitment and Description of Subjects

A total of 30 subjects (3 male, 27 female) ranging in age from 18 to 27 years were included in this study. No significant differences were found between groups for any demographic variable (Table 1). Mean age in the auditory distraction (music) group was 20.0 ± 1.6 years, the visual distraction group was 21.30 ± 2.4 years and for the control group was 22.0 ± 2.9 years ($p=0.172$). All subjects completed one independent exercise session at the Jesse Owens South Recreation Center, the Ohio State University. The auditory distraction (music) group had 2 men and 8 women, the visual distraction group had no men and 10 women and the control group had 1 man and 9 women ($p=0.10$). No significant difference was noted for gender ($p=0.354$). The primary reason men who were approached regarding participation in the study did not qualify for participation was their planned exercise of weight training, not aerobic training or exercise. A convenience sample of 30 subjects was used with all subjects consenting to participate and all completing the study. The majority ($n=29$) of the sample were single, with only one married participant in the auditory distraction (music) group. No significant difference was noted for marital status ($p=0.381$). Twenty-three of the participants were enrolled as undergraduate students, while seven participants held a bachelor's degree or higher ($p=0.110$). The study was homogeneous with 29 caucasian participants and one Asian participant. No African-American participants were identified who met the inclusion criteria of aerobic exercise who were willing to participate in the study. In light of the sample homogeneity, there was no difference between groups for ethnicity ($p=0.381$). No difference was noted between groups for employment ($p=0.800$), with 17 students who were not working, 11 students who were working,

one non-student who works part-time and one non-student who works full-time. The majority of the sample lives with others who are not partners ($n=23$), one lives with a significant other/partner and 4 live alone ($p=0.878$). Ten subjects self-selected to each of the 3 groups, auditory distraction (music), visual distraction, and control groups.

Table 1

Enrolled Subjects Demographics

Variable	AudD Group		VisD Group		Control Group		P Value
	No.	%	No.	%	No.	%	
Age, yrs							0.172
< 22	9	(30%)	6	(20%)	6	(20%)	
≥ 22	1	(3.3%)	4	(13.3%)	4	(13.3%)	
Gender							0.354
Male	2	(6.6%)	0	(0%)	1	(3.3%)	
Female	8	(26.6%)	10	(33.3%)	9	(30%)	
Marital Status							0.381
Single	9	(30%)	10	(33.3%)	10	(33.3%)	
Married	1	(3.3%)	0	(0%)	0	(0%)	
Education Completed							0.110
< Bachelor's	10	(33.3%)	7	(23.3%)	6	(20%)	
≥ Bachelor's	0	(0%)	3	(10%)	4	(13.3%)	
Ethnicity							0.381
Caucasian	9	(30%)	10	(33.3%)	10	(33.3%)	
Asian-American	1	(3.3%)	0	(0%)	0	(0%)	
Current Employment							0.800
Student	6	(20%)	5	(16.6%)	6	(20%)	
Working student	4	(13.3%)	4	(13.3%)	3	(10%)	
Works PT	0	(0%)	1	(3.3%)	0	(0%)	
Works FT	0	(0%)	0	(0%)	1	(3.3%)	
Social Support							0.878
Lives w/others	7	(23.3%)	8	(26.6%)	8	(26.6%)	
Lives w/partner	1	(3.3%)	1	(3.3%)	1	(3.3%)	
Lives alone	2	(6.6%)	1	(3.3%)	1	(3.3%)	

AudD = auditory distraction; VisD = visual distraction; yrs = years

B. Baseline Variables

There were no significant differences between groups at baseline in EFI subscores, including positive engagement ($p=0.315$), revitalization ($p=0.551$), physical exhaustion ($p=0.608$) or tranquility ($p=0.244$). However, a significant difference was noted in exercise self-efficacy ($p=0.043$), with the mean ESE score of the auditory distraction (music) group of 90.75 in contrast to the ESE of the visual distraction group (mean = 70.625) and the control group (mean = 74.875). This finding supports the use of the ESE score as a co-variate in the planned analysis (Table 2).

Table 2

Baseline Information

Variable	AudD Group Mean (SD)	VisD Group Mean (SD)	Control Group Mean (SD)	P Value
ESE	90.75 (12.43)	70.63 (18.7)	74.88 (21.1)	0.043*
EFI				
PE	6.9 (2.6)	8.2 (2.7)	6.5 (2.4)	0.315
R	5.6 (2.2)	5.4 (2.9)	4.3 (3.3)	0.551
PhE	4.9 (2.4)	6.0 (2.8)	6.1 (3.5)	0.608
T	7.1 (2.2)	8.4 (1.8)	7.1 (1.9)	0.244

= significance; AudD = auditory distraction; VisD = visual distraction; yrs = years; ESE = exercise self-efficacy score; EFI = Exercise-induced Feeling Inventory; PE = positive engagement subscore; R = revitalization subscore; PhE = physical exhaustion subscore; T = tranquility subscore.

C. Results Relating to the Research Questions

Multivariate Analysis of Outcome Variables

Due to the significant differences seen between groups in the exercise self-efficacy (ESE) score at baseline, the ESE score was used as a co-variate in the multivariate analysis. No significant difference was noted between groups (auditory distraction, visual distraction or control) for all variables using multivariate analysis of covariance [MANCOVA] (Pillai's Trace $F=0.797$; $df=16, 40$; $p=0.681$). An observed power of 42.6 percent was found. Due to low power, there is potential of a Type II error; in order to eliminate this error, a larger sample size would be needed.

Research Questions

Q1: Do healthy adults who aerobically exercise using distraction (auditory or visual) or no stimuli (control) differ in their feeling states?

H1.1: Healthy adults who aerobically exercise using distraction (auditory or visual) will report improvement in their post-exercise feeling states as compared to their pre-exercise feeling states during the single aerobic exercise session.

The data supports the first hypothesis (that exercise distraction is related to improved post-exercise feeling states) for one of the four EFI subscales. When the distraction groups were analyzed as a single distraction group, comparison of post-exercise EFI scores revealed a significant difference in the revitalization subscale (t-test, $p = 0.037$). However, the other three subscales showed no significant differences for change in EFI scores including the positive engagement subscale ($p=0.121$), the physical exhaustion subscale ($p=0.171$) and the tranquility subscale ($p=0.754$).

Q2: Does the type of distraction (visual vs. auditory) as compared to no distraction have differential effects on feeling states during aerobic exercise?

H2.1: Auditory distraction will impact feeling states more positively as compared to visual distraction or no distraction when used during aerobic exercise.

No significant differences were found when univariate analysis of covariance (ANCOVA) was generated for each of the EFI subscores using the ESE score as the covariate. Findings include: post-exercise EFI positive engagement subscore ($F= 0.976$, $df\ 3$, $p=0.419$), post-exercise EFI revitalization ($F=1.848$, $df\ 3$, $p=0.163$), post-exercise EFI physical exhaustion subscore ($F=1.299$, $df\ 3$, $p=0.296$), and post-exercise EFI tranquility subscore ($F=0.638$, $df\ 3$, $p=0.597$). These findings support the null hypothesis that the type of distraction has no differential effects on feeling states.

However, when change scores from pre-exercise to post-exercise are evaluated in relation to the EFI subscores, significant differences are noted across time. Across all three groups (auditory, visual, and control), there were significant improvements in EFI subscales of

positive engagement ($p = 0.001$, mean difference = 1.667) and revitalization ($p = 0.000$, mean difference = 3.967). This adds further support to the evidence for the positive emotional effects of aerobic exercise.

Q3: Is exercise self-efficacy a significant variable in determining feeling states during aerobic exercise?

H3.1 Exercise self-efficacy has a moderating influence on feeling states during aerobic exercise.

The ESE scores were not significantly correlated to any of the four EFI subscales and thus show no significant relationship with feeling states. This is in contrast to previous research which demonstrated positive correlations between self-efficacy scores and feeling states. However, the fact that there were significant differences among groups at baseline underscores the necessity of controlling for self-efficacy as a moderating variable.

Chapter V.

Discussion

In summarizing the findings of this study, the data support the first hypothesis and do not support the second and third hypotheses. According to the results, healthy adults who aerobically exercised using either type of distraction reported a significant change in the EFI subscale of revitalization when compared with the control group. Participants using auditory distraction did not report differential change in feeling states as compared to those using visual distraction. In addition, analysis of all three groups as a whole showed significant change in the EFI subscales of positive engagement and revitalization.

The data for the first hypothesis correspond to the findings of Hayakawa, Takada, Miki, and Tanaka, which indicated a significant increase in vigor for participants who performed bench-stepping exercise with music as auditory distraction, compared to the control group, and measured by pre- to post-exercise POMS (2000). The relationship between the concepts of

vigor and revitalization would need to be analyzed in detail to fully understand how these studies complement one another, but both terms are used to denote a positive emotional state.

Because the correlation with revitalization is true for both distraction groups combined, the results of this study are unsupportive of the findings of Russell et al., which concluded that visual distraction during exercise was not correlated with any significantly greater change in feeling states as measured by the POMS (2003). There is, therefore, an ambiguity in the research on whether visual distraction alone does indeed have a specific effect on feeling states.

One interpretation of this finding is that while the different types of distraction may not be shown by this study to have any differential effects, the use of either type of distraction during exercise enhances the positive change in feeling states that occurs with aerobic exercise, allowing the exerciser focused on distractive stimuli to finish a workout feeling more revitalized than those who had no external focus apart from exercise itself.

That there was no significant improvement in the other three EFI subscales is of little concern at this time. Most likely it would not be necessary for an individual to expect dramatic positive improvements in all feeling states subscales; it is plausible that a positive effect on revitalization without an accompanying effect on tranquility, for example, would still be worth the consideration of someone who wants to discover the method of exercise that will maximize the exercise experience

While it was not the focus of this study to provide additional support for the emotional benefits of exercise regardless of use of distraction, the findings relating all three exercise groups to a significant increase in revitalization and positive engagement are still valuable. This finding is congruent with Russell et al., who found that when all three exercise groups (distraction and control) were combined into a single exercise group, there was a significant change in feeling states from pre- to post-exercise. This adds to the research database on the

benefits of aerobic exercise, which is becoming increasingly important as a sedentary population demands evidence for the benefits of exercise.

The primary limitation of this study is obviously the small sample size; a larger sample size would be needed to obtain a greater power in order to determine whether there are differential effects for the music and visual distraction groups. Another limitation is the homogeneity in gender, race, and age of the sample population, which was comprised overwhelmingly of white females. Lack of control over study conditions introduced potential variables such as peer influence, when two participants filled out their EFI forms together and discussed their answers, and the confounding effect of weight training performed in addition to aerobic exercise, despite researcher instructions. In addition, use of a quasi-experimental design reduces generalizability. Suggestions for future study include utilizing a larger sample size, recruiting for subgroups differentiated by race and gender, and use of randomized assignment to the intervention in order to obtain results that are more generalizable to a broad population.

As for clinical relevance, the value of this study to health care is that it may allow providers to encourage the use of distraction as a way to maximize the psychological benefits of exercise. At this time there is not enough evidence to promote one form of distraction over another, but further research will shed more light on these differences. Knowing how to improve one's feeling states through exercise may serve as an incentive for people to make the choice to exercise, allowing them to reap the physiological benefits as well.

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